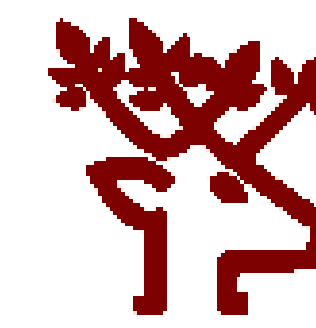
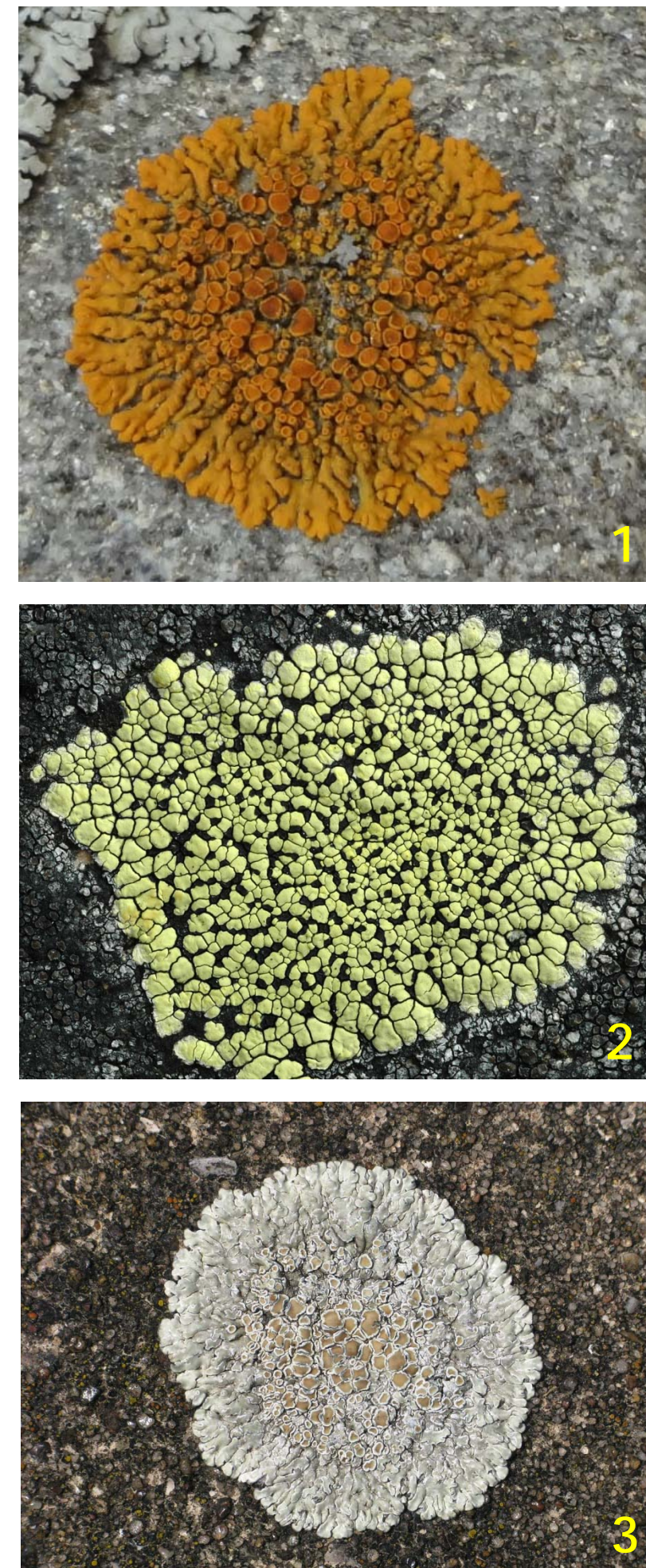


Assessing the impacts of climate change on lichens in the Indian Himalayan Region

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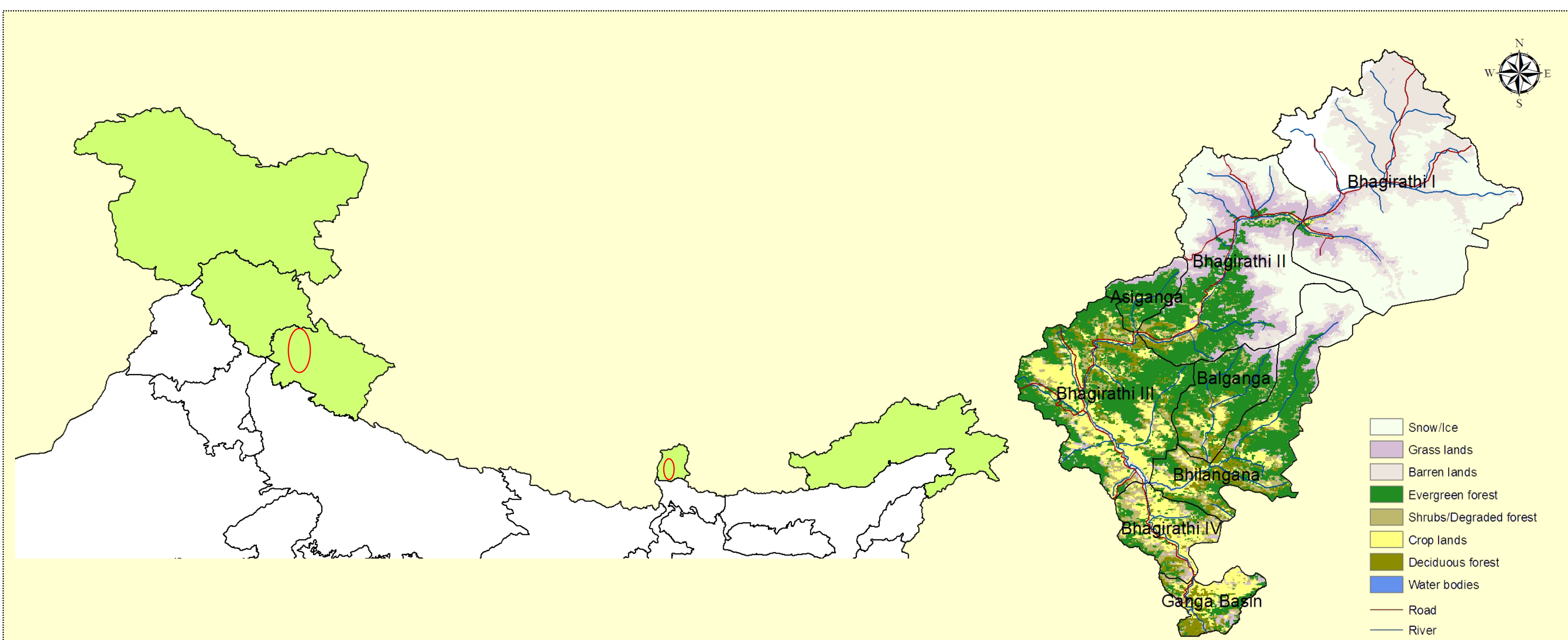
Abstract

The symbiotic association in lichens makes them one of the most unique organisms on the earth, capable of inhabiting the extreme environmental condition and pioneer habitats. Lichens are most effective and reliable indicators of ecosystem functioning, environmental conditions and are sensitive to a wide variety of environmental stressors like habitat destruction, air pollution and climate change. The Indian Himalayan Region (IHR) is considered as one of the most sensitive region for climate change as compared to other parts of Indian subcontinent. The high resolution regional climate models revealed that temperature and precipitation in the Himalayan region will continue to increase in future, and these changes are further likely to impact the distribution of various life forms including lichens. The goal of this work is to establishing baseline data on lichens diversity along altitudinal gradient for understanding the possible impacts of climate change. To achieve these objectives Wildlife Institute of India has launched a collaborative study with CSIR-NBRI (National Botanical Research Institute) in IHR. We discuss current status of knowledge on possible impacts of climate change on lichens in IHR, proposed methodology for addressing the lichen diversity (on elevation gradient) and experimental setup for assessing the possible impact of climate change on lichen diversity and its distribution, in pilot areas located in western and eastern Himalaya. The proposed methodology is lichenometry, OTCs (Open Top Chambers) and climatic modelling. Currently we selected seven sub-basins in the Bhagirathi basin to prepare the lichen inventory in the region. During the reconnaissance survey we collected lichen species along different altitude gradients within different vegetation and land-use types. A total 52 species of lichens have been identified, among these *Heterodermia diodemata*, *Flavoparmelia caperata* and *Everniastrum cirrhatum* are commonly distributed.

Background:

- Lichens, the most successful symbiotic organisms on earth, constitute the dominant life form over as much as 8% of earth surface (Ahmadjian 1995) and forms a very important part of cryptogamic vegetation in alpine habitat of Himalaya (Upreti 1998).
- They are most effective and significant bioindicator of ecosystem functioning and are sensitive to air pollution and climate change (Hyvarinen 1992, Ellis et al. 2007, Shukla et al. 2015).
- Lichens show rapid response to climate change. Being swift coloniser that disperses well, lichen species shift from tropical to higher temperate regions due to global warming (Aptroot 2009).
- The Indian Himalayan Region (IHR) is considered as one of the most sensitive region for climate change as compared to other part of Indian subcontinent.

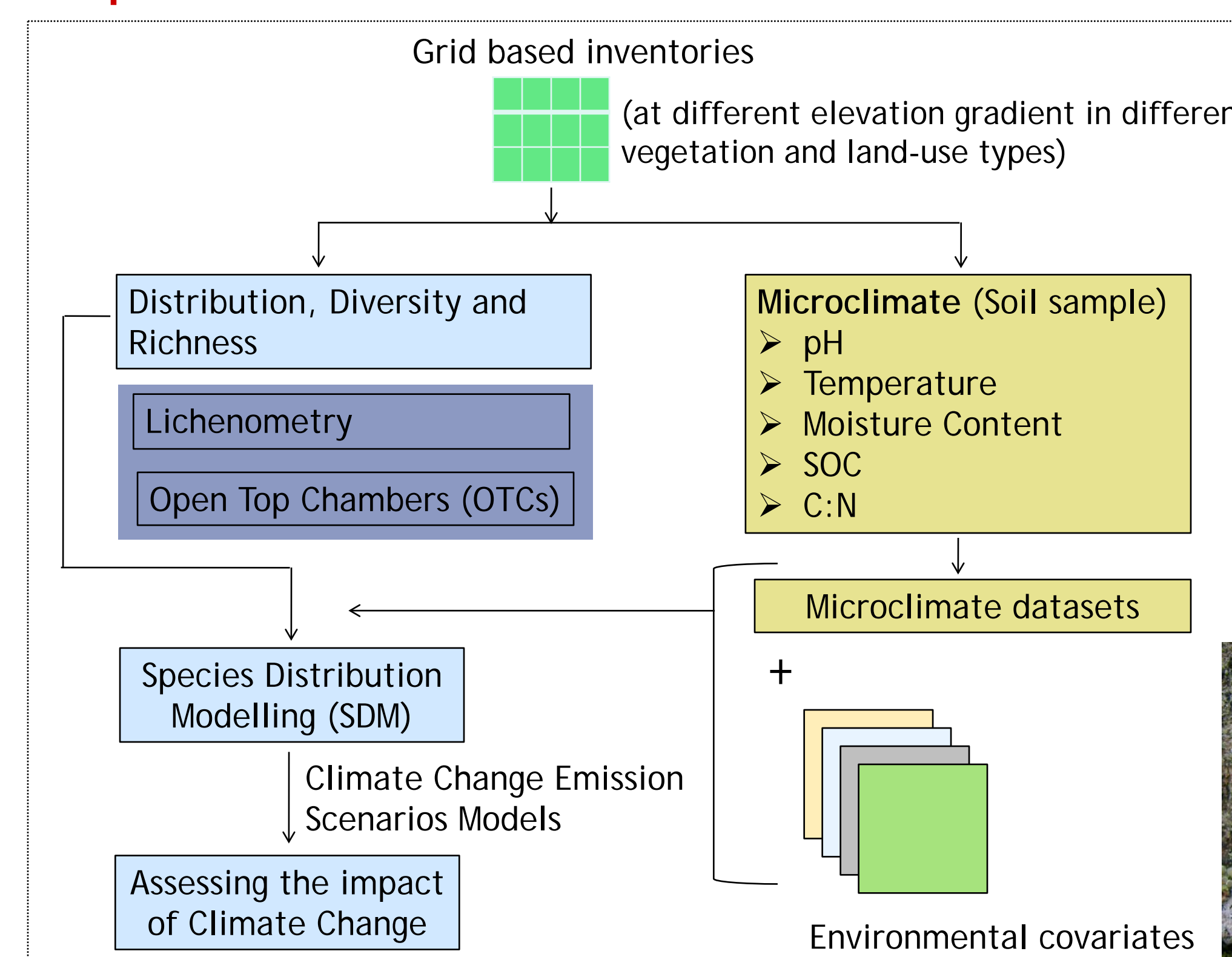
Study Area:



Objectives:

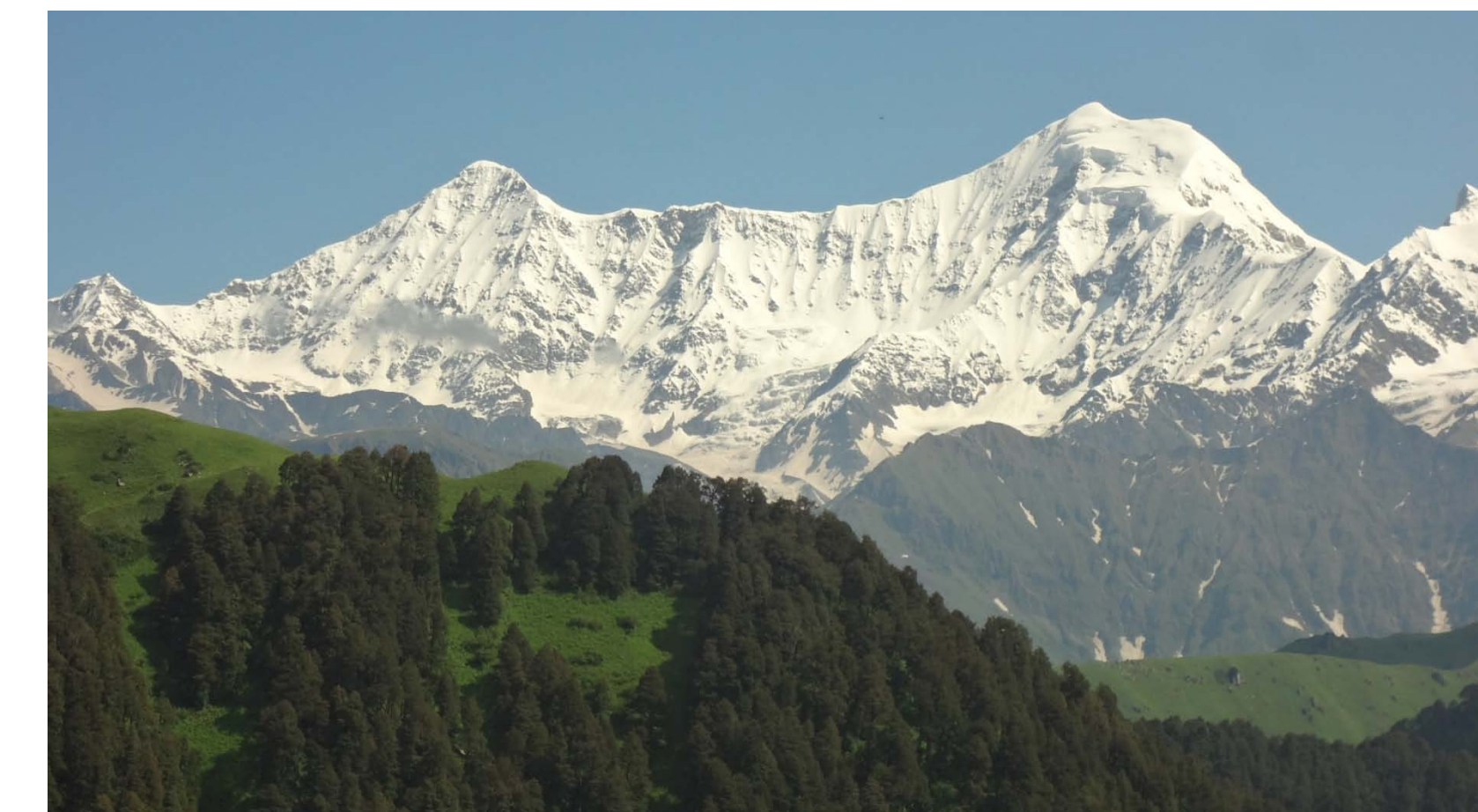
- To determine the patterns of diversity along altitudinal gradients and with changing vegetation types and land use
- To know the difference between Western and Eastern Himalaya in terms of lichen diversity
- To assess the lichen diversity changes under different future climatic scenarios

Proposed Work Plan:



National Mission for Sustaining the Himalayan Eco-system (NMSHE)

Realizing the need for developing science based action plans to address both the existing as well as emerging threats of climate change in the fragile mountain ecosystems of the IHR, the National Mission for Sustaining the Himalayan Ecosystem (NMSHE) has been conceived as part of the National Action Plan on Climate Change (NAPCC) under the coordination of the Department of Science & Technology (DST) and is expected to offer practical adaptation strategies.



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- Dr. D. K. Upreti, Chief Scientist, Lichenology Laboratory, CSIR-NBRI, Lucknow
- Supervisors and Researchers of Team NMSHE, WII, Dehradun



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|------------------------------------|-----------------------------------|
| 1. <i>Xanthoria elegans</i> | 5. <i>Rhizoplaca chrysroleuca</i> |
| 2. <i>Rhizocarpon geographicum</i> | 6. <i>Cladonia fimbriata</i> |
| 3. <i>Lecanora muralis</i> | 7. <i>Heterodermia diodemata</i> |
| 4. <i>Flavoparmelia caperata</i> | 8. <i>Usnea orientalis</i> |
| | 9. <i>Physcia gomukhensis</i> |

Expected Outcome:

- Baseline data on spatial distribution, diversity and richness of lichens along altitudinal gradients in different vegetation and land-use types of IHR.
- Influence of climatic factors on lichens distribution
- Identify key indicator species for long term climate change monitoring based studies
- Monitor the impact of climate change on lichen diversity

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